RESPONSE OF PEAR FRUIT CV. *BUTIRRA PRECOCE* MORETTINI TO $KMNO_4$, BREAD YEAST AT TWO STORAGE PERIODS.

Sarfaraze **F**atah **A**li **AL-B**amarny, **Sh**ukri **H**aji **S**alih **B**ani and **A**bulrahman **A**li **M**ohamad.
Dept. of Horticulture, Faculty of Agriculture and Forestry, University of Duhok, Kurdistan region – Iraq.
(Accepted for publication: November 15, 2015)

Abstract:

This study was carried out on fruits of five years old pear trees (*Pyrus communis* L) in the central laboratory in Agricultural Faculty/ Duhok University / Iraqi Kurdistan Region, during growing season 2012, to investigate the effect of potassium permanganates ($KMnO_4$), bread yeast and storage periods on fruit storage behavior of Butirra Precoce Morettini pear fruit. The results revealed that the fruit treated with 10 g $KMnO_4$ / bag increased significantly the firmness but the weight loss percent was significantly decreased. Also fruit dipped in 4% bread yeast caused a significant increase in weight loss percent, juice volume and juice percent. Whereas TSS, firmness, juice percent, total sugars and total acidity were decreased as storage prolonged from 56 days to 127 days, except weight loss percent which increased significantly during the same storage periods. The effect of the interaction between $KMnO_4$ and bread yeast levels with storage periods was significant. The interaction between 20g $KMnO_4$ /bag and 56 days storage resulted in the highest fruit firmness, but the best interaction in decreasing weight loss was 10g $KMnO_4$ /bag with 56 days storage. On the other hand, the interaction between 20g $KMnO_4$ /bag with 127 days storage gave the lowest acidity. Concerning the increasing of ascorbic acid in fruits, the best interaction was 20g $KMnO_4$ /bag with 127 days storage.

Keyword: Pear Fruit, *Pyrus communis* L, Bread yeast, Storage period.

Introduction

The pear (*Pyrus communis* L.) is any of several tree and shrub species of genus Pyrus in the family Rosaceae. Several species of pear are valued for their edible fruits, while others are cultivated as ornamental trees. The pear is native to coastal and mildly temperate regions of the old world, from Western Europe and North Africa east right across Asia. Pears fruits may be stored at room temperature until ripe. Ripe pears are optimally stored refrigerated, uncovered in a single layer, where they have a shelf life of 2 to 3 days (Potter *et al.*, 2007). Butirra Precoce Morettini (Bartlett x Coscia) is an Italian cultivar, one of the best early pears. Juicy, rich, sweet-spicy white flesh under greenish-yellow skin blushed with red. The tree in general, is vigorous in growth and a heavy in yield. Early season harvest (2 weeks before Bartlett) and stores longer than Bartlett. Pollinate with D'Anjou, Bartlett, Conference, Red Clapp. Moderate resistant for fire-blight (Radicati *et al.,* 1995).

Potassium permanganate ($KMnO_4$) is dark purple crystals, can be easily dissolved in water at room temperature. The potassium permanganate uses and benefits are many, where the material is used as a sterile or sanitized for washing fruits and vegetables. Also, the other importance use is inhibiting the growth of microorganisms that cause spoilage of fruits, as well as fungi that cause rot in many types of fruit (Wills and Wills, 1995).

In addition to the foregoing, the use and importance of potassium permanganate in research storage fruits not less than previously reported in terms of maintaining the integrity of the fruit during storage and reduce the physiological injury and extent the storage period of fruit (Wills and Warton, 2004).

It considered the most effective system for absorbing ethylene produced from fruits and oxidizing them (Joseph and Butler, 2008). It can be seen that the effectiveness of $KMnO_4$ through their color. When it changes color from flashing purple to brown color, it means effectiveness of $KMnO_4$ finished and it will be changed (Ayoub, *et. Al.,* 1995).

Bread yeast may be used as soil applications, spray solutions or soaking solutions, because dry yeast is containing several nutrients including N, P, K, Mg, Ca, Na, Mn, Zn, Cu, B and Mo, total protein (5.3%), total carbohydrates (4.7%), and some hormones (IAA 0.5 ppm and GA3 0.3ppm) (Tartoura *et al.,* 2001). The first possibility of using the active bread yeast for improving growth and fruit quality was published by Suriabananont (1992) and Stino *et al.,* (2009). However, the different positive effects of applying active bread yeast as a newly used bio-fertilizer were attributed to its own

component from different nutrients, higher percent of proteins, massive amount of vitamin B and the natural plant growth hormone namely cytokinins (Ferguson *et al.,* 1987; Idso *et al.,* 1995 and Hashem *et al.,* 2008). Today, bread yeast (Saccharomyces cervisiae) as a natural bio-stimulant appeared to induce an astonished influence on growth and yield of many crops, since it has various basic function, i.e. CO_2 production as well as formation of alcohol, acids and esters (Magoffin and Hoseney, 1974 and Martinez-Anoya *et al.,* 1990).

Application of yeast to pear fruit one week before harvest at 1.0 to 1.5 × 10^8 CFU / ml resulted in establishment of large populations of yeast on fruit surfaces, but did not reduce postharvest fungal decay incidence in 3 years of testing. In one year, ziram sprays applied two weeks before harvest significantly reduced yeast populations (Sugar *et al.,* 2003).

Results showed that spraying Keitte mango trees once at full bloom with algae at 2% combined with yeast at 0.2% was very effective in improving fruit set, fruit retention, yield as number of fruits or weight (kg) / tree and increased fruit length (cm), fruit width (cm), fruit weight (g), pulp/fruit percentage and enhanced total soluble solids (T.S.S.) (Elham *et al.,* 2010).

The study was aimed to find out the effect of potassium permanganates as absorbent of ethylene and bread yeast as a bio-fertilizer on storage characteristics when prolonged storage period of pear fruit cv. Butirra Precoce Morettini.

Materials and Methods

The present study was carried out in 2012 growing season on pear fruits (*Pyrus communes* L.) cv. Butirra Precoce Morettini (Bartlett x Coscia) cultivar, grown at orchard of horticulture department/ Agricultural Faculty/ Duhok University. The selected trees were 5 years old, received all required service operations along the season.

The Fruits of pear were harvested manually at optimal commercial gravest on 25 September 2012 and transported in plastic boxes to the central laboratory, then the fruits were placed directly in cold room for pre-cooling treatment, after that, fruits were selected uniformity in shape, color and size and any blemished fruits were discarded.

Potassium permanganate at 0, 10, and 20g / bag (polyethylene bags) and bread yeast at 0, 4 and 8% were prepared as aqueous solutions. Healthy pear fruits of Morettini cv. were dipped in bread yeast at 20°C for 5 minutes, then they left to dry on thick cloth piece. Before storage potassium permanganates at above concentrations were put in Petri-dishes with fruits, and then the fruits of each treatment were put in perforated polyethylene bags, closed tightly. In addition three replications for each treatment with 10 fruits / replicate were put for weight loss and physiological injuries, then stored in cold storage at 0 ±1 °C and 90-95 % RH for stored for two periods (56 and 127 days).

The initial values of pear fruits parameters were taken periodically after 56 and 127 days out of cold storage (All the measurements were done on 10 fruits) to determine fruit quality characteristic such as:

A. **Firmness (Lb/cm^2):** Measured by using hand penetrometer with a plunger of 7.8mm.

2- Fresh fruit weight loss %: Fruits in each treatment were weighed before stored, then the weight loss was determined after each storage period for all treatments.

3- Total Acidity (%): The Total Acidity expressed as percent malik acid, was obtained by titrating 10 ml of juice with 0.1N NaOH (A.O.A.C., 1995).

4- Ascorbic acid (V.C mg/100ml juice): Was determined by 2, 6- di-chloro-phenol indo-phenol described by (A.O.A.C., 1995).

5- Total soluble solids (TSS) %: Total soluble solids were determined by table refractometer according to (A.O.A.C., 1995).

6- Total sugars (%): Was estimated by using the techniques of Seyoun (2002) after which the absorbance was determined by Jenway model 6100 spectrophotometer at 450nm.

7- Juice volume (ml/fruit): It was measured by grounding them and juice extracting, with the use of a lab-scal fruit juice extractor Juicer /blender, Panasonic, Mj, Japan.

8- Juice percent %: It was determined by dividing juice volume on fruit weight before juice extracting.

Statistical analysis: The data obtained were statistically analyzed as factorial experiment (two factors) in Complete Randomized Design. The all data were analyzed by SAS program (2002). Duncan's test at 5% level has been used for means comparing.

Results

Firmness (Lb/cm^2)

It can be observed from Table (1) that pear fruit treated with 10g $KMnO_4$ /bag. Significantly gave the highest fruit firmness (20.96 Lb./cm^2) as compared with non treated fruit, which had the lowest fruit firmness (18.36 Lb./cm^2), whereas there were no significant differences between other treatments. Fruit firmness was significantly decreased with the prolonged storage period from 56 days (22.51 Lb./cm^2) to 127 days (16.92 Lb./cm^2) at cold storage (0 ±1 °C).

Table (1): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on pear fruit firmness (lb.).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	20.93 ab	15.74 c	18.36 b*
$KMnO_4$ 10g	22.14 ab	19.78 b	20.96 a
$KMnO_4$ 20g	24.01 a	16.74 c	20.38 ab
Yeast 4%	22.52 ab	16.65 c	19.59 ab
Yeast 8%	22.99 a	15.69 c	19.34 ab
Means of storage periods	22.51 a	16.92 b	

*The same letter with rows and columns indicates that there is no significant difference ($p \leq 0.05$)

The higher fruit firmness (24.01 lb.) was observed in pear fruit treated with 20g $KMnO_4$ /bag and stored for 56 days which was significantly differed from the lowest fruit firmness in the interaction between fruit treated with 8% yeast and 127 days storage. In general fruit firmness of all treatment in 56 days storage was significantly higher as compared with firmness of fruit in all interaction treatment and 127 days storage.

Fresh Fruit Weight Loss (%)

Table (2) indicates that fresh fruit weight loss was significantly influenced when the fruit were treated with $KMnO_4$ and yeast, so it can be seen that the lowest fresh fruit weight loss was showed in fruit treated with 10 and 20 g $KMnO_4$ / bag (1.03 and 1.13% respectively) in compared with the highest fresh fruit weight loss in non treated fruits.

The fresh fruit weight loss of pear fruit (3.41%) stored for 127 days was higher significantly than pear fruit stored for 56 days (1.92 %).

Table (2): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on fresh fruit weight loss (%).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	3.00 c	4.91 a	3.95 a
$KMnO_4$ 10g	0.67 f	1.38 e	1.03 c
$KMnO_4$ 20g	0.79 f	1.46 e	1.13 c
Yeast 4%	2.78 c	4.95 a	3.86 a
Yeast 8%	2.35 d	4.35 b	3.35 b
Means of storage periods	1.92 b	3.41 a	

These results showed that the lowest value of fresh fruit weight loss of pear fruits was obtained from the interaction between 10g $KMnO_4$ and 56 days storage period (0.67%) which was significantly lower than other interactions treatment except with interaction between 20g $KMnO_4$ and 56 days storage. While, the highest value was noticed from the interaction of 4% yeast and 127 day storage period (4.95%).

Total Acidity (%)

Table (3) shows that there were no significant differences between non treated fruit and other treatments ($KMnO_4$ and yeast) in total acidity, therefore fruit treated with 10 $KMnO_4$ / bag had a higher total acidity (0.125%).

Pear fruits stored for 56 days superior significantly (0.135%) on fruits stored to 127 days in increase total acidity (0.093%).

Table (3): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on total acidity (%).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	0.132 ab	0.098 a-c	0.115 a
$KMnO_4$ 10g	0.141 a	0.109 a-c	0.125 a
$KMnO_4$ 20g	0.134 ab	0.082 c	0.108 a
Yeast 4%	0.132 ab	0.094 bc	0.113 a
Yeast 8%	0.138 a	0.083 c	0.111 a
Means of storage periods	0.135 a	0.093 b	

It is clear from the results in the table (3) that total acidity of pear fruits treated with 10g $KMnO_4$ and 56 days storage period was higher (0.141%) as compared with lower total acidity (0.082%) in the combination between 20g $KMnO_4$ and 127 days storage.

Ascorbic acid (V.C mg/100ml juice)

No significant differences were noticed between non treated fruit and all other treatments ($KMnO_4$ and yeast) in V.C content of fruit. Also no significant differences were found in V.C content of fruit stored at 56 days and 127 days (Table 4).

Table (4): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on ascorbic acid (V.C mg/100ml juice).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	0.480 a-c	0.520 ab	0.500 a
$KMnO_4$ 10g	0.520 ab	0.520 ab	0.520 a
$KMnO_4$ 20g	0.360 c	0.600 a	0.480 a
Yeast 4%	0.560 ab	0.440 bc	0.500 a
Yeast 8%	0.520 ab	0.520 ab	0.520 a
Means of storage periods	0.488 a	0.520 a	

The highest value of V.C was observed in the interaction between 20 $KMnO_4$ and 127 days storage (0.6 mg V.C /100 ml juice) which differ significantly from the interaction treatment of 20g $KMnO_4$ and 56 days storage (0.36 mg V.C /100 ml juice).

Total soluble solids (TSS) %

Table (5) showed that fruits TSS% was not influenced significantly by all treatments of $KMnO_4$ and yeast as compared with control treatment, but when the fruit stored for period prolonged the TSS of fruit decreased significantly (Table 5).

Table (5): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on fruit TSS (%).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	17.38 a	15.82 cd	16.60 a
$KMnO_4$ 10g	15.98 b-d	16.30 bc	16.14 a
$KMnO_4$ 20g	15.79 cd	16.12 bc	15.96 a
Yeast 4%	16.83 a-c	15.05 d	15.94 a
Yeast 8%	16.97 ab	15.02 d	16.00 a
Means of storage periods	16.59 a	15.66 b	

The higher TSS presented in the combination between non treated fruit and storage period for 56 day. While, the lower TSS% occur as a result of the interaction between 8% yeast and 127 days storage period (Table 5).

Total Sugar (%): No significant differences were recorded between non treated and $KMnO_4$ and yeast treatments in total sugar of pear fruit observed from data in (Table 6), but the highest fruit total sugar (14.39%) resulted from non treated fruits. In addition fruit total sugar (%) of 56 days storage exceeded the fruit total sugar stored for 127 day.

Table (6): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on total sugar of fruit (%).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	15.12 a	13.66 cd	14.39 a
$KMnO_4$ 10g	13.81 b-d	14.11 bc	13.96 a
$KMnO_4$ 20g	13.64 cd	13.94 bc	13.79 a
Yeast 4%	14.61 a-c	12.95 d	13.78 a
Yeast 8%	14.74 ab	12.92 d	13.83 a
Means of storage periods	14.38 a	13.52 b	

The interaction between $KMnO_4$ and storage periods significantly affected on pear fruits total sugar. The interaction between non treated fruits and 56 days storage was dominant to other interaction treatments.

Juice volume (ml/fruit)

With regard to fruit juice volume, fruits treated with 4% yeast were significantly more juice volume (90.25 ml/fruit) as compared with the least juice volume which resulted when fruit treated with 20g $KMnO_4$ /bag (76.2 ml/fruit) (Table 7). On the other hand, there were no significant differences between other treatments. Also, the results in the same table indicated that juice volume of fruit not influenced significantly by storage periods.

Table (7): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on juice volume (ml/fruit).

Treatments	Storage periods (day)		Means of treatments
	56	127	
Control	86.20 a	83.08 a	84.64 ab
KMnO4 10g	88.17 a	82.43 a	85.30 ab
KMnO4 20g	85.00 a	67.40 b	76.20 b
Yeast 4%	89.17 a	91.33 a	90.25 a
Yeast 8%	91.17 a	87.67 a	89.42 a
Means of storage periods	87.94 a	82.38 a	

The interaction between 4% yeast and 127 days storage were superior significantly only with the interaction between 20g $KMnO_4$ and 127 days storage which had the lowest juice volume. In general speaking, we can say that there was no significant difference in juice volume between all other interaction treatments.

Juice Percent (%): Fruit treated with 4% yeast were significantly superiored in juice percent to fruit treated with 20g $KMnO_4$ /bag only, while no significant difference was observed between all treated fruit in juice percent. On the other hand, juice percent of fruit was decreased significantly when the storage period prolonged from 56 days to 127 days (Table 8).

Table (8): Effect of $KMnO_4$, bread yeast, storage periods and their interaction on juice percent (%).

Treatments	Storage periods		Means of treatments
	56	127	
Control	65.29 a	62.59 a	63.94 a
$KMnO_4$ 10g	62.94 a	62.37 a	62.65 a
$KMnO_4$ 20g	60.26 a	46.24 b	53.25 b
Yeast 4%	64.20 a	64.32 a	64.26 a
Yeast 8%	61.60 a	61.89 a	61.75 a
Means of storage periods	62.86 a	59.48 b	

Pear fruit treated with the combination treatment of non treated fruit and 56 days storage give the higher juice percent, which was significantly higher only from the lower juice percent in the combination between 20g $KMnO_4$ and 127 days storage. But no significant were recorded in juice percent between all other interactions.

Discussion

Potassium permanganate treatment influenced positively on maintaining fruit quality significantly after being stored for 127 days**.** The effect of potassium permanganate in the maintains of pear fruits firmness may be due to the proposition that ethylene is a contributing factor (Forsyth *at.el.*1996). The impact absorbing substances such as potassium permanganate absorb ethylene and other volatile compounds and reduce its negative impact on firmness; this was confirmed by Ayoub *et. Al.,* (1995) that the use of potassium permanganate with fruits performs on the absorption and oxidation of ethylene produced from the fruit to carbon dioxide and water and thus decrease its concentration surrounding the fruit. The lack of ethylene oxidation by oxidizing substances, such as potassium permanganate and others will lead to the accumulation of ethylene produced by the fruits leading to a re-absorption by the fruit through its ability to link with the receptors present in the cell membrane proteins have the ability to move more than once through the fatty layer of membranes cellular leading to stimulation of pectines enzyme which led to transform calcium pectate from insoluble to soluble. These results have been endorsed what found by Chander (1991) that the weight loss of apple fruit packaged in bags containing crystals of potassium permanganate reduced, firmer and contents higher pectines after stored for 210 days, and with the result founded by (Sayyari and Rahemi, 2003 and Al-Bamarny 2008) When they stored apple fruit with potassium permanganate they show decrease in ethylene and retain the fruits firmness compared to non-treated fruits.

About the effect of storage period, the results declared that prolonging the storage period from 56 to 127 days resulted in a decrease in fruit firmness and total acidity, but fruit weight loss and vitamin C increased. Generally attributed these effects to prolong the storage period to progress of fruits in maturity, the process of maturation in the climacteric fruit is a set of steps include an increase in the manufacture of ethylene, high rate of respiration, softening and change in taste and flavor, ethylene have clear role in these changes (Albeles *et. Al.,* 1992). There were many studies indicated, that the increasing rate of respiration and ethylene production, were gotten during fruit maturity progressed in storages (Wills and Warton, 2000). Also the high rate of respiration and ethylene production during fruit ripening in cold storage associated indirectly to decrease the concentration of calcium in the fruit as a result of storage prolonged. Since calcium plays an important and essential role in the regulation of these physiological processes that lead to ripening where its maintain the unity of the cell wall as well as to perform linking pectin polymers which limit the entry of hydrolytic enzyme to cell components (Siddiqui and Bangerth, 1996). Obaid, 2005 and Al-Bamarny, 2008 noted that the concentration of calcium in the fruit decreased gradually during storage period. Also Barreiro *et al.,* (2003) described that one of the biological processes that occur in fruits at maturity and after that is increase the production of ethylene, which stimulates processes maturity through stimulation of hydrolysis enzyme which associated with the breakdown of the cellular wall and fruit senescence, led to changes in the composition of cell membranes by stimulating the enzymes responsible for the change in membranes lipid and make increases the permeability of cell membranes, or the loss in fruit firmness may be a result of the maturity lead to loss of interdependence between cells through transformation insoluble calcium pectates to soluble due to the increased effectiveness of the enzyme polygalacturonase and pectinesterase who composed and increase their activities during the early stages of the fruits soften (Harker *et. Al,.* 1997). As to the loss of the fruit acidity during the storage period may be interpreted on the basis of transformation amino acids into sugars during maturation (Hayat *et. Al.,* 2003).

Al-Ani (1985) revised the increase in the content of vitamin C apple juice during storage, to the concentration of acids not be fixed in the fruit after harvest but to be in constant change, and each acid change was independently from other acids depending on the stored temperature, fruits stored in low temperatures and an appropriate RH preserve it is content of ascorbic acid. The current results are similar for all the qualities mentioned to the findings of Attia (1986) when studying the effect of duration storage in the storage characteristics of Anna apple fruit and to the results of Moran (2006) when studying the effect of storage period on storage characteristics of apple fruit cv. McIntosh and Cortland.

Conclusions

Concerning to these results, the treatment of 10g KMnO4 was better than 20g KMnO4 in increasing fruit firmness and decreasing weight loss percent. Fruit storage for 56 days was better than 127 days in improving the most studied characters. The best interaction in enhancing many characters was 10 and 20 g KMnO4 with storage for 56 days. In general, there was no clear effect of yeast on studied parameters during storage period.

References

Al-Ani, A-I. M., (1985). Physiology of horticultural crops after harvesting the first part. Ministry of Higher Education and Scientific Research, Baghdad University.

AL- Bamarny, S. F. A.(2008). Effect of treatments with some chemical compounds on storage characteristics of Golden Delicious and Red Delicious apple. Ph.D. Thesis, Hort. And Landscape Design / Fruit / coll. Agric. & Forestry/ Mosul University.

Albeles, F. B.; P.W. Morgan and M.E. Saltveit (1992). Ethylene in plant bio. Academic: San Diego, CA, 182-185.

A. O. A. C. (1995). Official Method of Analysis 16th Ed. A. O. A. C. International Gaithersburg, M. O.

Attia, N. A. (1986). Effect of some growth regulators on fruit quality of Anna apples. Ms.C. Thesis, Ain Shams University, Egypt.

Ayoub, A. J.; G. Margarat; Driver and Irwin and A.Taub (1995). Use of ethylene absorbers in extending shelf life. CJS ethylene filters. Handbook of Toxic Properties of Monomers and Additives.

Barreiro, M. G.; V. Quartin ; A. Paula and P.S. Campos (2003). Influence of postharvest calcium treatments on membrane lipids composition and quality of "Bravo de Esmolfe" apples. Biblioteca de ciencias, 12: 321-325.

Chander, V. B. (1991). Studies on ethylene management and storage of 219 ackaged apple (*Malus domestica* Borkh) cv. Red Delicious.Ph. D. Thesis, India.

Elham, Z. A. E., M. F. M. Shahin, M. H. El-Sheikh and M. M. M. Abd-El-Migeed (2010). Effect of algae extract and yeast application on growth, nutritional status, yield and fruit quality of Keitte mango trees. Agric. & Bio. J. of North America. ISSN online: 2151-7525.

Ferguson, J. J.; W. T. Aving; L. H. Allen and Koch, K. E. (1987). Growth of Co2 Enriehed sour orange seedlings treated with gibberellic acid and cytokinins. Proc. Florida-State Hort. Soc. 38(2): 363-375.

Forsyth, F. R.; C. A. Eaves and H. J. Lighrfoot (1996). Storage quality of McIntosh apples as affected by removel of ethylene from the storage atmosphere. Can. J. plant. Sci., 49:567-572.

Harker, F. R. ; R. J. Redgwelll; I. C. Hallett and S. H. Murray (1997). Texture of fresh fruit. Horticultural Reviews, 20: 121-224.

Hashem, M.; Y. M. Omran and M. Nashwa Sallam (2008). Efficacy of yeasts in the management of root-knot nematode (Meloidogyne incognita) in flame seedless grape vines and the consequent on the productivity of the vines. Biocontrol Science and Technology 18(4): 357-375.

Hayat, I.; T. Masud and H.A. Rathore (2003). Effect of coating and warpping materials on shelf life of apple (*Malus domestica* Borkh). Internet J. of Food Safety, (5) 24 – 34.

Idso, S. B; R. L. Garcia; B. A. Kimball and J. K. Hoober (1995). Effect of atmosphere CO_2 enrichment and foliar methanol application on net photosynthesis of orange trees (*Citrus aurantium*) leaves. Amer. Botany 82(1): 26-30.

Joseph K. and P. Butler (2008). Smart Packaging Technologies for Fast Moving. SBN: 978-0-470-02802-5, 356 pages, April, 2008.

Magoffin, C. D. and R. C. Hoseney (1974). A review of fermentation. Baker"s Dig. 48(12): 22.

Martinez-Anoya, M. A., Pitarch, B., Bayarri, P. and Beneditode barber, C. (1990). Microflora of the sour doughs wheat flour bread interaction between yeast and lactic acid bacteria in wheat doughs and their effects on bread quality. Cereal Chem. 6: 85.

Moran, E. R. (2006). Maintaining fruit firmness of McIntosh and Cortland apples with ReTain® and SmartFresh℠. Fruit Notes, 71.

Obaid, H. (2005) Effect of some chemical compounds in the storage ability of the fruits of two varieties Golden Delicious and Starking Delicious apple. Damascus Univ. J. Agric. Sci., 21 (1): 109-126.

Potter, D.; T. Eriksson; R. C. Evans; S. Oh; J. E. E. Smedmark; D. R. Morgan; M. Kerr; K. R. Robertson; M. Arsenault; T. A. Dickinson; C. S. Campbell (2007). "Phylogeny and

classification of Rosaceae". *Plant Systematics and Evolution* **266** (1–2):543. doi: 10.1007/s00606-007-0539-9. [Referring to the subfamily by the name "Spiraeoideae"].

Radicati, L., I. Martino and G. Vergano (1995). Apple and Pear Cultivars of Piemonte (ITALY) in Pomological Descriptions of 18th and 19th Centuries. Acta Hort. (ISHS) 391:273-282.

SAS Institute, Inc (2002). Statistical Analysis System Ver. 9.0. SAS institute Inc., Cary, NC. USA.

Sayyari, M. and M. Rahemi (2003). Role of heat treatment, calcium chloride and potassium permanganate. J. Sci. Tech. Agr. Nature Res, 6 (4) : 67 – 77.

Siddiqui, S. and F. Bangerth (1996).The effect of calcium infiltration on structural changes in cell walls of stored apples. J. Hort. Sci., 71:703 – 708.

Stino, R.G.;. A. T. Mohsen; M. A. Maksoud; M.M.M. Abd elmigeed; A. M. Gomaa, and A. Y. Ibrahim (2009). Bio-organic fertilization and its impact on Apricot young trees in newly reclaimed soil. Amer-Eurasian J. Agric. and Environ. Sci., 6(1): 62-69.

Sugar, D., L. M. Benbow, K. A. Powers and S. R. Basile (2003). Effects of sequential calcium chloride, ziram and yeast orchard sprays on postharvest decay of pear. Plant Diseases / Vol. 87 No. 10.

Suriabananont, V. (1992). Fertilizer trails on mangoes (*Mangifera indica*) var. Nan Dok Mai in Thailand. Acta Hort. (321): 529-534.

Tartoura, E.A.A. (2001). Response of pea plants to yeast extract and two sources of N-fertilizers. J. Agric. Sci., Mansoura Univ., 26(12): 7887-7901.

Wills, R. B. H and M. A. Warton (2000). Anew rating scale for ethylene action on postharvest fruits and vegetables.Improving postharvest Technologies of Fruits, Vegetables and Ornamentals, IIR Confernce, Murcia: 43-47.

Wills, R. B. H and M. A. Warton (2004). Efficacy of potassium permanganate impregnated in to alumina beads to reduce atmospheric ethylene. J. Amer. Soc. Hort. Sci., 129 (3):433 – 438.

Wills, R. B. and H. Wills (1995). Effect of ethylene on storage life of lettuce. J. Sci. Food Agr., 69: 197-201.and M. A.

كارڤەدانا لبێت بەرهەمێ هرمیكێ توخمێ (*Butirra Precoce* Morettini) بو بەرمەنگەناتێت پوتاسیومی و هەڤیر ترشێ نانی و دوو ماوێت عمبارکرنێ.

پوختە:

ئەڤ ڤەكولینە لسەر بەرهەمێ هرمیكێ (ژیێ 5 سالیدا) ل لابورا مەلبەندی ئەوا بسەر فاكولتیا چاندنیێ ڤە –زانكویا دهوك – هەریما كوردستانا عیراقێ هاتە ئەنجامدان ، بو تاقیكرنا كارتێكرنا بەرمەنگناتێت پوتاسیومی ($KMnO_4$) و هەڤیر ترشێ نانی وماوێت عمبارکرنێ لسەر سەروبەرێ عمبارکرنا هرمیكێ ژ توخمێ (***Butirra Precoce*** **Morettini**). ئەنجاما دیاركر كو كارلێكا لبێت هرمیكێ ب 10 گم بەرمەنگەناتێت پوتاسیومی \تورك بو ئەگەرێ زێدەبونەكا بەرجاڤ یا رەقاتیا گوشتیێ هرمیكێ لێ بەروڤاژی بو ئەگەرێ گێمبونەكا بەرجاڤ یا رێژا ژدەستدانا كێشێ. و هەروەسا نقومكرنا لبێت هرمیكێ لناڤ 4٪ هەڤیرترشێ نانی بو ئەگەرێ زێدەبونەكا بەرجاڤ یا هەر ئێك ژ رێژا ژدەستدانا كێشێ ، قەبارێ شەربەتیێ و رێژا شەربەتیێ. لێ ئەڤ ساخلەتێن هە كێم بون دگەل دریژ بونا ماوێ عمبارکرنێ ژ 56 بو 127 روژ وەكی رێژا كەرستێن رەقێن حەلیای ، رەقاتیا گوشتیێ هرمیكێ ، رێژا شەربەتیێ ، شەكرا سەرجەمی و ترشاتیا سەرجەمی ، ژبلی رێژا ژدەستدانا كێشێ ئەوا زێدەبوی زێدەبونەكا بەرجاڤ. كارتێكرنا لێگدانیێ ل ناڤبەرا هەر ئێك ژ بەرمەنگەناتێت پوتاسیومی و هەڤیرترشیێ نانی دگەل ماوێت عمبارکرنێ یا بەرجاڤ بو. لێگدان دناڤبەرا 20گم بەرمەنگەناتێت پوتاسیومی و56 روژ ژعمبارکرنێ بو ئەگەرێ زێدەبونەكا بەرجاڤ یا رەقاتیا گوشتیێ هرمیكێ ، لێ باشترین لێگدان بو كێمكرنا رێژا ژدەستدانا كێشێ ئەو بو دناڤبەرا 10گم بەرمەنگەناتێت پوتاسیومی \تورك و 56 روژ عمبارکرن. وژلایەكێدیڤە ، لێگدان دناڤبەرا 20گم بەرمەنگەناتێت پوتاسیومی \تورك و 127 روژ عمبارکرن بو ئەگەرێ پەیداكرنا گێمترین رێژا ترشاتیێ دناڤ شەربەتا هرمیكێ. لێ سەبارەت زێدەبونا ترشێ ئەسكوربیكی لناڤ شەربەتا هرمیكێ ، باشترین لێگدان ئەوبو دناڤبەرا 20 گم بەرمەنگەناتێت پوتاسیومی \تورك و 127 روژ عمبارکرن.

استجابة ثمار الكمثرى صنف (***Butirra Precoce*** **Morettini**) الى برمنكنات البوتاسيوم ، خميرة الخبز وفترتي خزن.

الخلاصة:

اجريت هذة الدراسة على ثمارأشجار الكمثرى (بعمر 5 سنوات) في المختبر المركزي التابع لفاكولتي الزراعة – جامعة دهوك – اقليم كوردستان العراق خلال موسم النمو 2012 لاختبار تأثير برمنكنات البوتاسيوم ($KMnO_4$) ، خميرة الخبز و فترتي خزن على السلوك الخزني لثمار الكمثرى صنف (***Butirra Precoce*** **Morettini**). اظهرت النتائج بأن معاملة الثمار ب 10غم برمنكنات البوتاسيوم \كيس سببت زيادة معنوية في صلابة لحم الثمار ونقصان معنوي في نسبة فقدان الوزن . نقع الثمارأيضا في 4 % خميرة الخبز أدى الى زيادة معنوية في كل من نسبة فقدان الوزن ، حجم العصير و نسبة العصير. بينما وجد بان نسبة المواد الصلبة الذائبة ، صلابة لحم الثمار ، نسبة العصير ، السكريات الكلية و الحموضة الكلية انخفضت قيمها باطالة العمر الخزني من 56 الى 127 يوم ، ماعدا نسبة فقدان الوزن التي زادت معنويا خلال نفس فترات الخزن. تأثير التداخل بين كل من مستويات برمنكنات البوتاسيوم و مستويات خميرة الخبز و فترتي الخزن كانت معنوي ، حيث ان التداخل بين 20غم برمنكنات البوتاسيوم \كيس و 56 يوم خزن كانت معنوي في زيادة صلابة لحم الثمار ولكن افضل تداخل في تقليل فقدان الوزن كانت 10غم برمنكنات البوتاسيوم \كيس مع 56 يوم خزن. ومن جانب آخر ، التداخل بين 20غم برمنكنات البوتاسيوم \كيس مع 127 يوم خزن اعطت اقل نسبة حموضة في عصير الثمار. أما بخصوص زيادة حامض الاسكوربيك في عصير الثمار ، فان افضل تداخل كانت بين 20غم برمنكنات البوتاسيوم و 127 يوم خزن.